Small Business Innovation Research/Small Business Tech Transfer

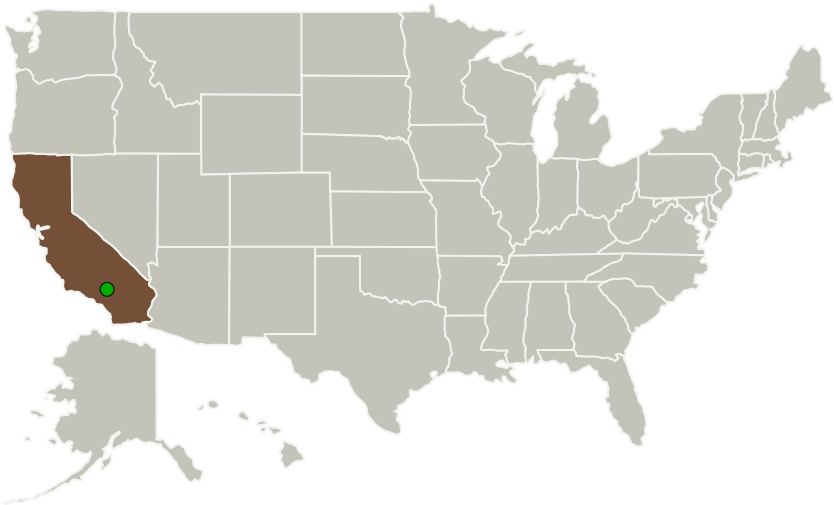
Cryogenic and Non-Cryogenic Hybrid Electric Distributed Propulsion with Integration of Airframe and Thermal Systems to Analyze Technology Influence, Phase I

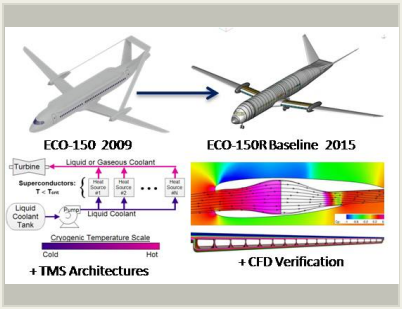
Completed Technology Project (2015 - 2015)

Project Introduction

A design iteration of ESAero's ECO-150 split wing turboelectric distributed propulsion (TeDP) concept is proposed to incorporate recent lessons learned in synergistic configuration opportunities, propulsion and thermal management system research and tool development, and aeropropulsive benefits reported by Lockheed Martin. Non-cryogenic and cryogenic/superconducting components will be included in three separate propulsion system architectures: one cooled via conventional "warm" coolant, one cryogenically cooled with a cryocooler system, and one cryogenically cooled with a liquid hydrogen blow-down system. The effort will begin with an interagency collaborative "Brainernet" brainstorming session to identify and assess technology and concept drivers and opportunities. Detailed configuration, aerodynamics, performance, and mission analysis will complement the effort, culminating in three flagship TeDP or hybrid electric distributed propulsion (HEDP) concepts which embody the propulsion-airframe-thermal integration (PATI) paradigm. A 2D and 3D CFD evaluation of the integrated propulsor will validate the physics-based aerodynamics and propulsor analysis tools. The lessons learned from the effort will establish a conceptual design roadmap for HEDP aircraft that are sensitive to PATI factors while also identifying path-critical technologies and design driving parameters for the propulsion and thermal management systems.

Primary U.S. Work Locations and Key Partners





Cryogenic and Non-Cryogenic Hybrid Electric Distributed Propulsion with Integration of Airframe and Thermal Systems to Analyze Technology Influence, Phase I

Table of Contents

Cryogenic and Non-Cryogenic Hybrid Electric Distributed Propulsion with Integration of Airframe and Thermal Systems to Analyze Technology Influence, Phase I

Completed Technology Project (2015 - 2015)

Organizations Performing Work	Role	Type	Location
Empirical Systems Aerospace, Inc.(ESAero)	Lead Organization	Industry	Pismo Beach, California
Armstrong Flight Research Center(AFRC)	Supporting Organization	NASA Center	Edwards, California

Primary U.S. Work Locations
California

Project Transitions

June 2015: Project Start

December 2015: Closed out

Closeout Summary: Cryogenic and Non-Cryogenic Hybrid Electric Distributed P ropulsion with Integration of Airframe and Thermal Systems to Analyze Technolo gy Influence, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/138906)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Empirical Systems Aerospace, Inc. (ESAero)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

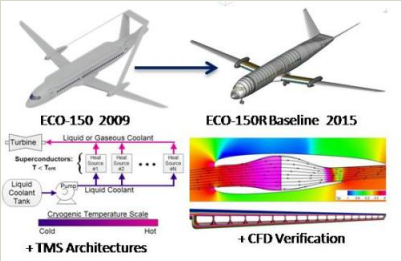
Principal Investigator:

Benjamin T Schiltgen

Cryogenic and Non-Cryogenic Hybrid Electric Distributed Propulsion with Integration of Airframe and Thermal Systems to Analyze Technology Influence, Phase I

Completed Technology Project (2015 - 2015)

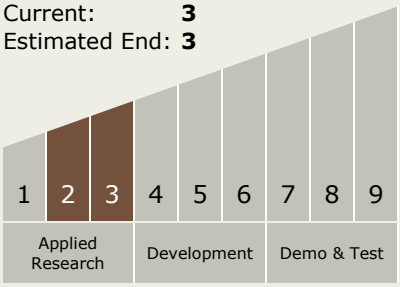
Images



Briefing Chart Image
Cryogenic and Non-Cryogenic Hybrid Electric Distributed Propulsion with Integration of Airframe and Thermal Systems to Analyze Technology Influence, Phase I
(https://techport.nasa.gov/image/126053)

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.3 Aero Propulsion
    - TX01.3.9 Hybrid Electric Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System